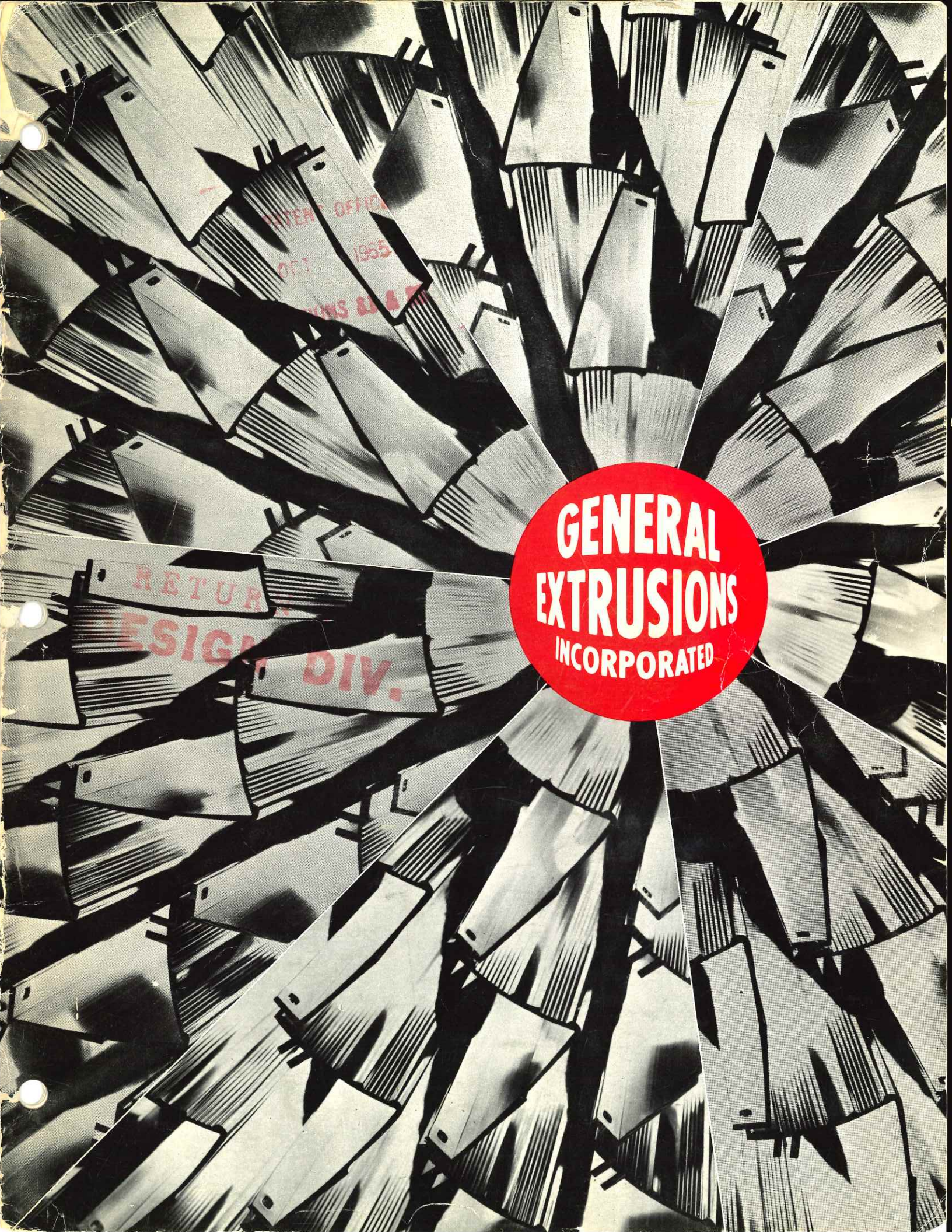
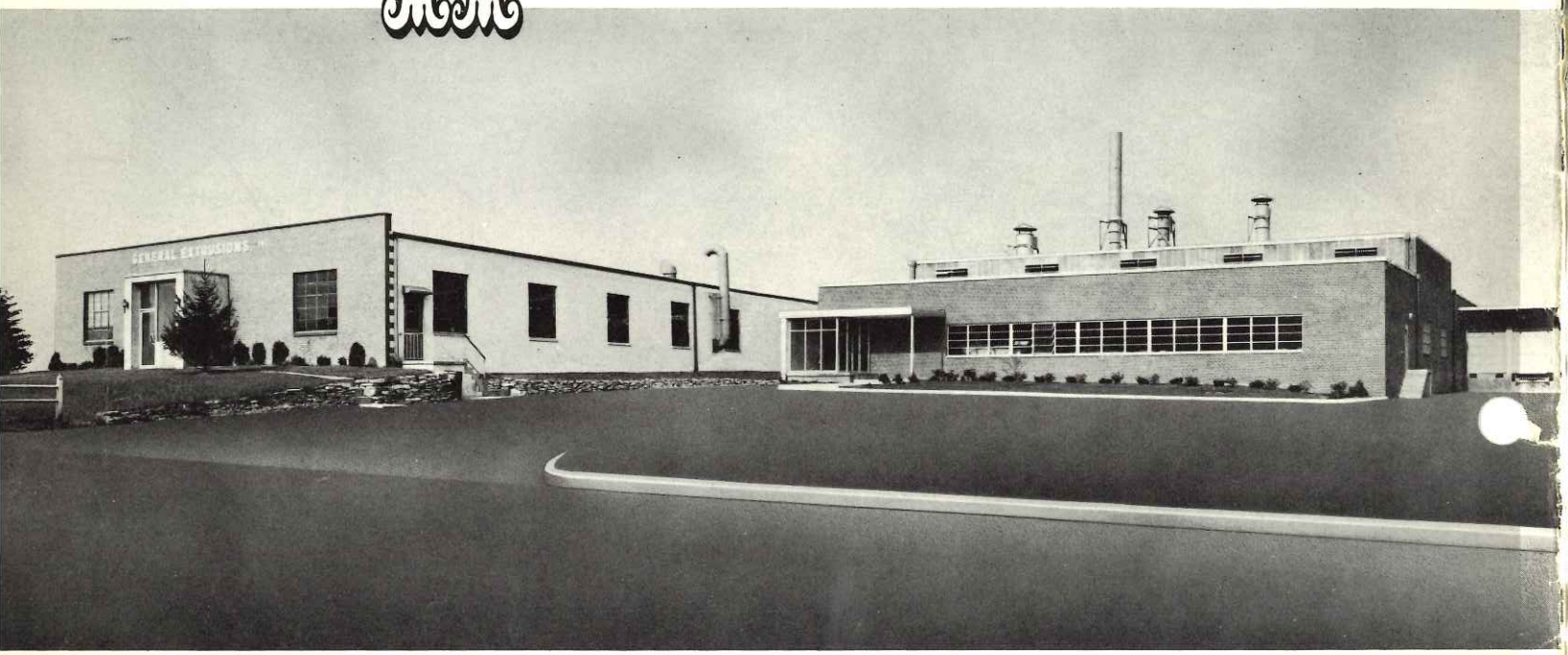

GENERAL
EXTRUSIONS
INCORPORATED

HOME OF "GENERALINE"



ALUMINUM EXTRUSIONS
INC.
"GENERALINE"

ALUMINUM EXTRUSIONS AND SERVICES

the address is the same . . . but GEI is now bigger to serve you better

GEI has doubled its production facilities with a building addition (shown at right in this photo). Expansions such as this are built on success in providing customers with product quality, unique and personal attention in meeting special needs. In addition to expanding all departments — from engineering to shipping — new production equipment has been installed. From design to packaging, GEI has the modern facilities to handle **every operation** in producing and processing aluminum extrusions . . . all under one roof.

GEI is equipped to provide high quality, uniformly close tolerance extrusions, plus related operations such as color and natural anodizing, heat treating, machining and fabrication. GEI is geared to rapid production and delivery of standard or special jobs. What's more, GEI engineers are constantly searching out and establishing new standards and improvements. Whatever the **specialized** nature of your requirements, GEI is eminently qualified and prepared to provide and produce the answers.

GENERAL EXTRUSIONS, INCORPORATED

4040 Lake Park Road • P. O. Box J • Telephone 788-9681 • YOUNGSTOWN 7, OHIO

CONTENTS

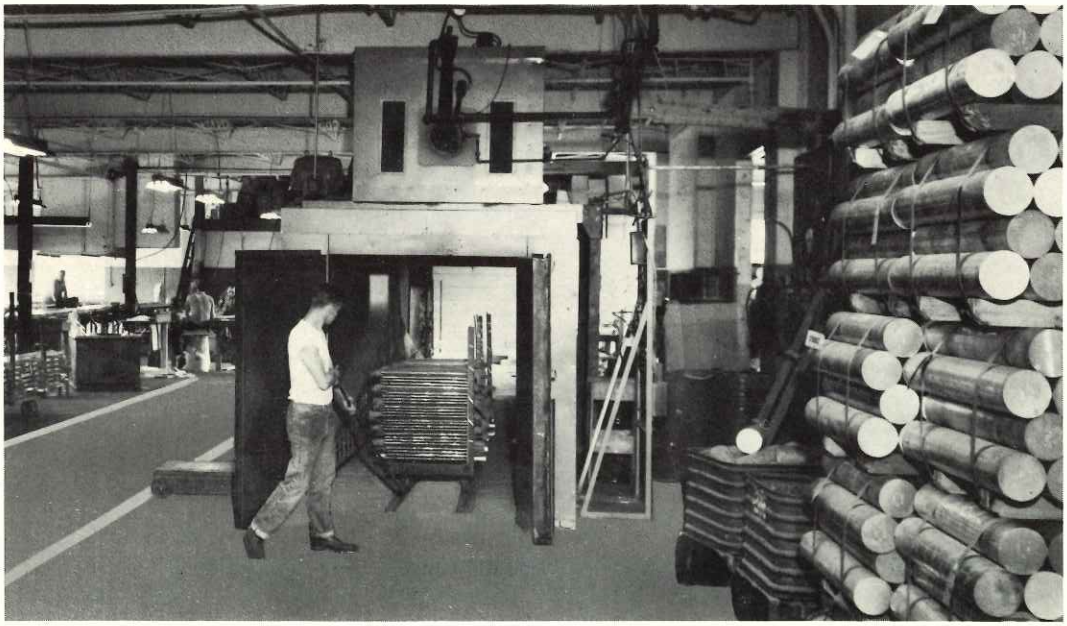
Extrusion Department 2-10
Mechanical Properties of Extrusions . . . 2
Standard Mill Finishes 2
Specification of Extrusion Alloys 3
Trade Phraseology 4
Tolerances of Rods, Bars and Shapes . . . 5-7
Tolerances for Extruded Tube 8-10
Fabricating Department 11, 12
Finishing Department 13-15
Anodizing Department 16
Shipping Department 17
G. E. I. Products 18-21

"GENERALINE" EXTRUSIONS

The heart of an aluminum extruder's operation is the Extrusion Department. Here the actual production of aluminum shapes begins. Here ability to extrude intricate shapes to close tolerances is the key to success and growth. For standard extrusions GEI has over 1,000 stock dies and the production facilities to compete with warehousing for both price and delivery. GEI is a "can do" organization in the Extrusion and all other departments shown on the following pages.

HOW TO SPECIFY EXTRUSION ALLOYS

Alloys Carried In Stock	PROPERTIES AND USES
EC-0	Electrical Conductor Grade, 99.45% minimum Aluminum.
1100	Good corrosion resistance, high ductility and formability. Can be anodized. Strength is comparately low. Use where formability is a major requirement and strength and stiffness are not.
3003	Good corrosion resistance, formability, and weldability. Somewhat higher strength than 1100.
5052	Good corrosion resistance, weldability and strength.
6061 6062	Both are resistant to corrosion and have good formability. Heat treatable to average high strengths. 6062 has a lower chromium content than 6061. Can be anodized.
6063	The best general extruding properties. Used for intricate sections, excellent for hollow extrusions. Takes good surface finish, is corrosion-resistant and can be anodized. Strength, as extruded, is higher than that of 3003 and can be heat treated to obtain still greater strength.
6463	This alloy should be used where finish is important, particularly after anodizing. Anodizing brings out a bright chrome-like appearance. Has all the mechanical and physical properties of 6063.



Aging oven is vital unit in Extrusion Department. Supply of ingots is shown at right.

"GENERALINE" EXTRUSIONS

TYPICAL MECHANICAL PROPERTIES

Alloy and Temper	Tensile Strength Pounds Per Square Inch	Yield Strength (Offset Equals 0.2%) Pounds Per Square Inch	Elongation Percent in 2 Inches		Brinnell Hardness 500# Kg. Load 10-MM Ball	Shearing Strength Pounds Per Square Inch
			Sheet Specimen (1/16" Thick)	Round Specimen (1/2" Diameter)		
EC-0	12,000	4,000	----	----	----	----------
1100-S-0	13,000	5,000	35	45	23	9,500
3003-S-0	16,000	6,000	30	40	28	11,000
5052-S-0	27,000	12,000	25	30	45	18,000
6061-F	18,000	8,000	22	30	30	12,500
6061-T4	35,000	21,000	22	25	65	24,000
6061-T6	45,000	40,000	12	17	95	30,000
6062-F	18,000	8,000	----	30	28	12,000
6062-T4	35,000	21,000	----	25	65	24,000
6062-T6	45,000	40,000	----	17	95	30,000
6063-T42	22,000	13,000	20	----	42	14,000
6063-T5	27,000	21,000	12	----	60	17,000
6063-T6	35,000	31,000	12	----	73	22,000
6463-T42	22,000	13,000	20	----	42	14,000
6463-T5	27,000	21,000	12	----	60	17,000
6463-T6	35,000	31,000	12	----	73	22,000

The values given in this table are averages which take into account the variations introduced by size, shape or method of manufacture.

STANDARD MILL FINISHES

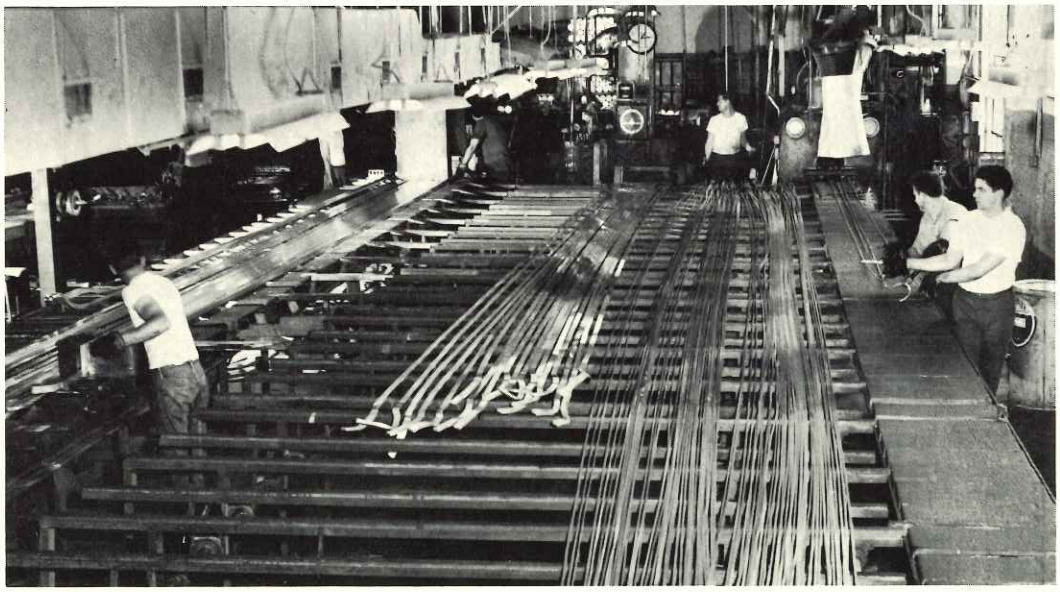
The exposed surfaces shown on section drawings of shapes will not exceed 150 R.M.S.*

No. 1 Finish: A finish where the appearance on the exposed surface of the finished product is a requirement and will not exceed 100 R.M.S.*

No. 2 Finish: A finish designed for subsequent polishing of the exposed surface and will not exceed 60 R.M.S.*

No. 3 Finish: A special finish designed for subsequent polishing. Applicable, when specified, to the following alloys and tempers: 1100-F, 3003-F, 6063 and 6463 standard tempers. Applicable to the portion of the exposed surface specified. Restricted to solid shapes only.

*R.M.S. (Root Mean Square) is a profilometer measurement of surface quality.



Lengths of aluminum being extruded in GEI's enlarged Extrusion Department.

TRADE PHRASEOLOGY*

EXTRUDED SHAPE — Any extrusion that cannot be classified as Rod, Bar or Tubing.

SOLID EXTRUDED SHAPE — Any extruded shape that cannot be classified as a hollow or a semi-hollow. (Figure 1).

SEMI-HOLLOW EXTRUDED SHAPE — An extruded shape, a part of whose wall-section partially forms a hollow in which the ratio of the area of the hollow to the square of the width of the gap is as follows (See Figure 2):

Gap width, inches	Ratio
Less than .062	Over 2
.062 to .124	Over 3
.125 to .249	Over 4
.250 to .499	Over 5
.500 and greater	Over 6

HOLLOW EXTRUDED SHAPE — An extruded shape, a part of whose wall-section forms a complete hollow.

Class 1 Hollow Extruded Shape — An extruded shape whose hollow is round and 1 inch or more in diameter, and whose shape is symmetrical about two or more equally spaced axes. (Figure 3).

Class 2 Hollow Extruded Shape — An extruded shape other than Class 1, having a single hollow and not exceeding a 5 inch circumscribing circle diameter in size.. (Figure 4).

Class 3 Hollow Extruded Shape — An extruded shape other than Class 1 or Class 2. (Figure 5).

STEPPED EXTRUDED SHAPE — An extruded shape whose cross-section changes in area at intervals in its length. (Figure 6).

EXTRUDED ROD — A solid extrusion whose cross-section is round. (Figure 7).

EXTRUDED BAR — A solid extrusion whose cross-section is a completely symmetrical square, rectangular, hexagonal, octagonal, or elliptical. Corners or edges may be sharp or rounded. (Figure 8).

EXTRUDED TUBING — A hollow extrusion whose wall is of uniform thickness and whose cross-section is completely symmetrical and is round, square, rectangular, hexagonal, octagonal, or elliptical. Corners may be sharp or rounded. (Figures 9 and 10).

*An extrusion which has the characteristics of more than one of the types listed should be referred to by the name of the more intricate type. Thus, an extrusion meeting the description of both a solid extruded shape and a hollow extruded shape should be termed a hollow extruded shape.

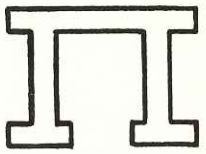


Fig. 1
Solid Extruded Shape

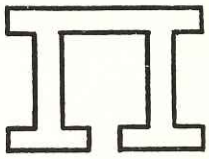


Fig. 2
Semi-Hollow Extruded Shape

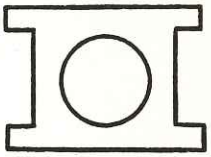


Fig. 3
Class 1 Hollow Extruded Shape

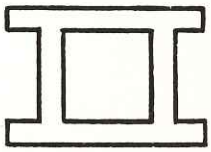


Fig. 4
Class 2 Hollow Extruded Shape

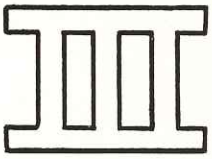


Fig. 5
Class 3 Hollow Extruded Shape

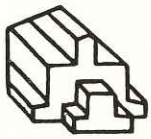
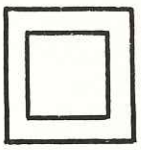


Fig. 6
Stepped Extruded

Fig. 7
Extruded Rod

Fig. 8
Extruded Bar

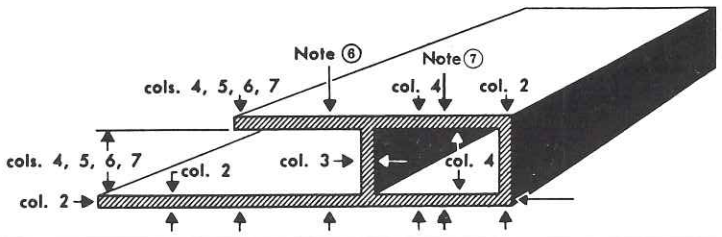


Figs. 9 and 10
Extruded Tube

STANDARD TOLERANCES

FOR EXTRUDED ROD, BAR AND SHAPES

TABLE 1 • CROSS-SECTIONAL DIMENSIONS *EXCEPT FOR SHAPES IN -T3510, -T4510, -T6510 AND -T8510 TEMPERS*⑧



SPECIFIED DIMENSION Inches	TOLERANCE②③—Inches Plus and Minus											
	METAL DIMENSIONS				SPACE DIMENSIONS							
	ALLOWABLE DEVIATION FROM SPECIFIED DIMENSION WHERE 75 PER CENT OR MORE OF THE DIMENSION IS METAL				ALLOWABLE DEVIATION FROM SPECIFIED DIMENSION WHERE MORE THAN 25 PER CENT OF THE DIMENSION IS SPACE⑥⑦							
	ALL EXCEPT THOSE COVERED BY COLUMN 3		WALL THICKNESS④ COMPLETELY⑤ ENCLOSING SPACE 0.11 SQ IN. AND OVER (Eccentricity)		AT DIMENSIONED POINTS 0.250-0.624 INCH FROM BASE OF LEG		AT DIMENSIONED POINTS 0.625-1.249 INCHES FROM BASE OF LEG		AT DIMENSIONED POINTS 1.250-2.499 INCHES FROM BASE OF LEG		AT DIMENSIONED POINTS 2.500 INCHES OR MORE FROM BASE OF LEG	
Col. 1	Col. 2		Col. 3		Col. 4		Col. 5		Col. 6		Col. 7	
	Alloys 5083, 5086, 5456	Other Alloys	Alloys 5083, 5086, 5456	Other Alloys	Alloys 5083, 5086, 5456	Other Alloys	Alloys 5083, 5086, 5456	Other Alloys	Alloys 5083, 5086, 5456	Other Alloys	Alloys 5083, 5086, 5456	Other Alloys
Up through 0.124	.009	.006			.015	.010	.018	.012	.021	.014	.024	.016
0.125-0.249	.011	.007			.018	.012	.021	.014	.024	.016	.030	.020
0.250-0.499	.012	.008			.021	.014	.024	.016	.027	.018	.033	.022
0.500-0.749	.014	.009	Plus	Plus	.024	.016	.027	.018	.030	.020	.039	.026
0.750-0.999	.015	.010	and	and	.027	.018	.030	.020	.033	.022	.045	.030
1.000-1.499	.018	.012	minus	minus	.030	.020	.033	.022	.039	.026	.051	.034
1.500-1.999	.024	.016	15% of	10% of	.036	.024	.042	.028	.051	.034	.075	.050
2.000-3.999	.036	.024	specified	specified	.048	.032	.054	.036	.072	.048	.096	.064
4.000-5.999	.051	.034	dimension;	dimension;	.063	.042	.075	.050	.096	.064	.132	.088
6.000-7.999	.066	.044	±.090 max	±.060 max	.081	.054	.093	.062	.123	.082	.168	.112
8.000-9.999	.081	.054	±.015 min	±.010 min	.096	.064	.111	.074	.150	.100	.204	.136
10.000-11.999	.096	.064			.111	.074	.132	.088	.174	.116	.240	.160
12.000-13.999	.111	.074			.126	.084	.150	.100	.201	.134	.276	.184
14.000-15.000	.120	.080			.135	.090	.159	.106	.213	.142	.294	.196

①*These Standard Tolerances are applicable to the average shape; wider tolerances may be required for some shapes and closer tolerances may be possible for others.*

②*The tolerances applicable to a dimension composed of two or more component dimensions is the sum of the tolerances of the component dimensions if all of the component dimensions are indicated.*

③*When a dimension tolerance is specified other than as an equal bilateral tolerance, the value of the Standard Tolerance is that which would apply to the mean of the maximum and minimum dimensions permissible under the tolerance.*

④*Where dimensions specified are outside and inside, rather than wall thickness itself, the allowable deviation (eccentricity) is ±10% of mean wall thickness; ±0.060 inch maximum, ±0.010 inch minimum. (Mean wall thickness is the average of two wall thickness measurements taken at opposite sides of the void.)*

⑤*In the case of Class I Hollow Shapes the standard wall thickness tolerance for extruded round tube is applicable.*

⑥*At points less than 0.250 inch from base of leg the tolerances in Col. 2 are applicable.*

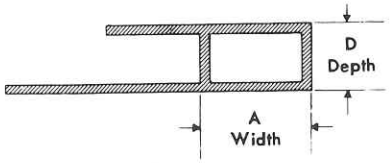
⑦*The following tolerances apply where the space is completely enclosed (hollow shapes):*

For the width (dimension A, below) the tolerance is the value shown in Col. 4 for the depth (dimension D).

For the depth (dimension D, below) the tolerance is the value shown in Col. 4 for the width (dimension A).

In no case is the tolerance for either width or depth less than at the corners (Col. 2, metal dimensions).

⑧*Tolerances for extruded shapes in -T3510, -T4510, -T6510 and -T8510 tempers shall be as agreed upon between purchaser and vendor at the time the contract or order is entered.*



Example—hollow shape having 1 x 3 inch rectangular outside dimensions: The width tolerance is ±0.024 inch and the depth tolerance ±0.032 inch. (Tolerances at corners, Col. 2, metal dimensions, are ±0.024 inch for the width and ±0.012 inch for the depth.)

STANDARD TOLERANCES

FOR EXTRUDED ROD, BAR AND SHAPES

TABLE 2 • STRAIGHTNESS *ROD, BAR AND SHAPES EXCEPT FOR -T3510, -T4510, -T6510 AND -T8510 TEMPERS*

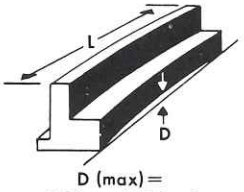
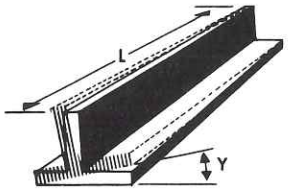
CIRCUMSCRIBING④ CIRCLE DIAMETER (SHAPES); SPECIFIED DIAMETER (ROD); SPECIFIED WIDTH (BAR) Inches	MINIMUM THICKNESS Inches	TOLERANCE② Inches	
		ALLOWABLE DEVIATION FROM STRAIGHT③  D (max) = .050 or .0125 x L	
		IN EACH FOOT OF LENGTH	IN TOTAL LENGTH OF PIECE
Under 1.500	Under 0.095	.050	.050 x Length, ft
Under 1.500	0.095 and over	.0125	.0125 x Length, ft
1.500 and over	.....	.0125	.0125 x Length, ft

TABLE 3 • STRAIGHTNESS *ROD AND BAR IN -T3510, -T4510, -T6510 AND -T8510 TEMPERS⑧*

SPECIFIED DIAMETER (ROD) SPECIFIED WIDTH (BAR)	TOLERANCE—Inches③	
	IN EACH FOOT OF LENGTH	IN TOTAL LENGTH OF PIECE
0.500 and over	.050	.050 x Length, ft

TABLE 4 • TWIST *BAR AND SHAPES EXCEPT FOR -T3510, -T4510, -T6510 AND -T8510 TEMPERS*

CIRCUMSCRIBING④ CIRCLE DIAMETER (SHAPES); SPECIFIED WIDTH (BAR) Inches	TOLERANCE②—Degrees	
	ALLOWABLE DEVIATION FROM STRAIGHT  Y (max) = 1°, ½°, or ¼° x L	
	IN EACH FOOT OF LENGTH	IN TOTAL LENGTH OF PIECE
Under 1.500	1°	1° x Length, ft
1.500-2.999	½°	½° x Length, ft: 5° max
3.000 and over	¼°	¼° x Length, ft: 3° max

①*These Standard Tolerances are applicable to the average shape: wider tolerances may be required for some shapes and closer tolerances may be possible for others.*

②*Not applicable to extruded products in the annealed (-0) temper.*

③*When weight of piece on flat surface minimizes deviation.*

④*The circumscribing circle diameter is the diameter of the smallest circle that will completely enclose the shape.*

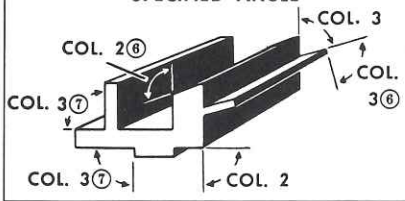
TABLE 5 • TWIST *BAR IN -T3510, -T4510, -T6510 AND -T8510 TEMPERS⑧*

SPECIFIED WIDTH (BAR) Inches	TOLERANCE—Degrees	
	IN EACH FOOT OF LENGTH	IN TOTAL LENGTH OF PIECE
0.500 to 2.999	1½	1½ x Length, ft; 7° max
3.000 and over	1	½ x Length, ft; 5° max

TABLE 6 • LENGTH⑤

CIRCUMSCRIBING④ CIRCLE DIAMETER (SHAPES); SPECIFIED DIAMETER (ROD); SPECIFIED WIDTH (BAR) Inches	TOLERANCE—Inches Plus			
	ALLOWABLE DEVIATION FROM SPECIFIED LENGTH			
	SPECIFIED LENGTH—Feet			
	Up thru 12	Over 12 thru 30	Over 30 thru 50	Over 50
Under 3.000	⅛	¼	⅜	1
3.000-7.999	3/16	5/16	7/16	1
8.000 and over	¼	⅜	½	1

TABLE 7 • ANGULARITY⑨

MINIMUM SPECIFIED LEG THICKNESS Inches	TOLERANCE Degrees Plus and Minus	
	ALLOWABLE DEVIATION FROM SPECIFIED ANGLE 	
	RATIO; ⑥⑦ LEG OR SURFACE LENGTH TO LEG OR METAL THICKNESS	
	1 and less	Over 1
Col. 1	Col. 2	Col. 3
Under 0.188	1	2
0.188-0.749	1	1½
0.750 and over	1	1

⑤*Applicable to straight lengths only.*

⑥*When the space between the surfaces forming an angle is all metal, values in column 2 apply if the larger surface length to metal thickness ratio is 1 or less.*

⑦*When two legs are involved the one having the larger ratio determines the applicable column.*

⑧*Tolerances for extruded shapes in -T3510, -T4510, -T6510 and -T8510 tempers shall be as agreed upon between purchaser and vendor at the time the contract or order is entered.*

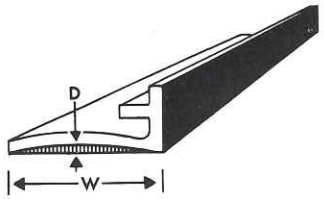
⑨*Not applicable to extruded shapes in -T3510, -T4510, -T6510 or -T8510 tempers. Tolerances for extruded shapes in these tempers shall be as agreed upon between purchaser and vendor at the time the contract or order is entered.*

STANDARD TOLERANCES

FOR EXTRUDED ROD, BAR AND SHAPES

TABLE 8 • FLATNESS (Flat Surfaces)④

SOLID AND SEMI-HOLLOW SHAPES, AND BAR



D (max) = .004 in. x W

Allowable deviation from flat: 0.004 inch per inch of width; 0.004 inch minimum.

TABLE 9 • FLATNESS (Flat Surfaces)④

HOLLOW SHAPES

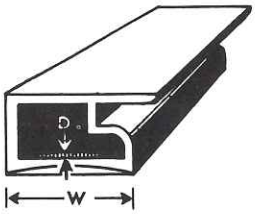
MINIMUM THICKNESS OF METAL FORMING THE SURFACE Inches	TOLERANCE Inches per Inch of Surface Width
	 D (max) = W x .004 or .006
Under 0.188	.006; .006 min
0.188 and over	.004; .004 min

TABLE 10 • SURFACE ROUGHNESS

SPECIFIED SECTION THICKNESS Inches	ALLOWABLE DEPTH OF DEFECTS② Inches Maximum
Under 0.064	.0015
0.064-0.125	.002
0.126-0.188	.0025
0.189-0.250	.003
0.251-0.500	.004
0.501 and over	.008

①These Standard Tolerances are applicable to the average shape; wider tolerances may be required for some shapes and closer tolerances may be possible for others.

②Defects include die lines and handling marks.

TABLE 11 • CORNER AND FILLET RADII④

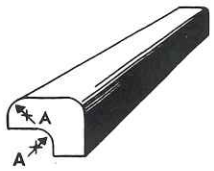
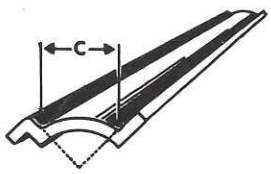
SPECIFIED RADIUS Inches	TOLERANCE—Inches ALLOWABLE DEVIATION FROM SPECIFIED RADIUS  Difference between radius A and specified radius
Sharp corners	+1/64
Under 0.188	±1/64
0.188 and over	±10%

TABLE 12 • SQUARENESS OF CUT ENDS

Allowable deviation from square: 1 degree.

TABLE 13 • CONTOUR (Curved Surfaces)④



C x 0.005 in.

Allowable deviation from specified contour: 0.005 inch per inch of chord length; 0.005 inch minmum.③

③As measured with a contour gauge whose surface is limited to a maximum subtended angle of 90 degrees. Extruded curved surfaces comprising more than a 90-degree subtended angle are checked by sliding the gauge across the surface, thus checking two or more 90-degree portions of the surface. Extruded shape surfaces comprised of arcs formed by two or more radii require the use of a separate contour gauge for each portion of the surface formed by an individual radius.

④Not applicable to extruded shapes in -T3510, -T4510, -T6510 or -T8510 tempers. Tolerances for extruded shapes in these tempers shall be as agreed upon between purchaser and vendor at the time the contract or order is entered.

STANDARD TOLERANCES
FOR EXTRUDED TUBE

TABLE 1 • DIAMETER *ROUND TUBE*

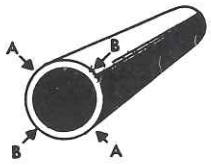
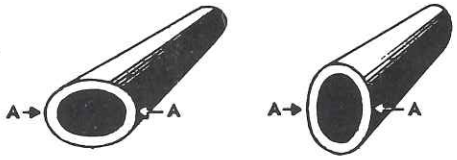
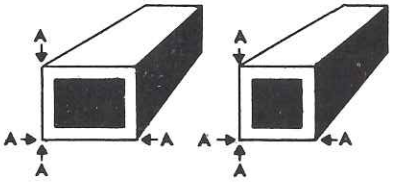
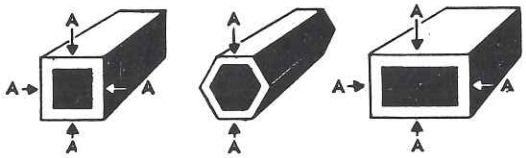
SPECIFIED OUTSIDE OR INSIDE DIAMETER① Inches	TOLERANCE②—Inches Plus and Minus			
	ALLOWABLE DEVIATION OF MEAN DIAMETER③ FROM SPECIFIED DIAMETER (Size)  Difference between ½ (AA+BB) and specified diameter		ALLOWABLE DEVIATION OF DIAMETER AT ANY POINT FROM SPECIFIED DIAMETER④ (Ovalness)  Difference between AA and specified diameter	
Col. 1	Col. 2		Col. 3	
	Alloys 5083, 5086, 5456	Other Alloys	Alloys 5083, 5086, 5456	Other Alloys
0.500- 0.999	.015	.010	.030	.020
1.000- 1.999	.018	.012	.038	.025
2.000- 3.999	.023	.015	.045	.030
4.000- 5.999	.038	.025	.075	.050
6.000- 7.999	.053	.035	.113	.075
8.000- 9.999	.068	.045	.150	.100
10.000-11.999	.083	.055	.188	.125
12.000-12.875	.098	.065	.225	.150

TABLE 2 • WIDTH AND DEPTH *SQUARE, RECTANGULAR, HEXAGONAL, OCTAGONAL TUBE*

SPECIFIED WIDTH OR DEPTH① Inches	TOLERANCE②—Inches Plus and Minus				
	ALLOWABLE DEVIATION OF WIDTH OR DEPTH AT CORNERS FROM SPECIFIED WIDTH OR DEPTH  Difference between AA and specified width or depth		ALLOWABLE DEVIATION OF WIDTH OR DEPTH NOT AT CORNERS FROM SPECIFIED WIDTH OR DEPTH④  Difference between AA and specified width, depth, or distance across flats		
	SQUARE, RECTANGULAR		SQUARE, HEXAGONAL, OCTAGONAL		RECTANGULAR
Col. 1	Col. 2		Col. 3		Col. 4
	Alloys 5083, 5086, 5456	Other Alloys	Alloys 5083, 5086, 5456	Other Alloys	
0.500-0.749	.018	.012	.030	.020	The tolerance for the width is the value in the previous column for a dimension equal to the depth, and conversely, but in no case is the tolerance less than at the corners.⑤
0.750-0.999	.021	.014	.030	.020	
1.000-1.999	.027	.018	.038	.025	
2.000-3.999	.038	.025	.053	.035	
4.000-4.999	.053	.035	.068	.045	
5.000-5.999	.068	.045	.083	.055	

①When outside diameter, inside diameter, and wall thickness (or their equivalent dimensions in other-than-round tube) are all specified, standard tolerances are applicable to any two of these dimensions, but not to all three.

②When a dimension tolerance is specified other than as an equal bilateral tolerance, the value of the standard tolerance is that which would apply to the mean of the maximum and minimum dimensions permissible under the tolerance.

③Mean diameter is the average of two diameter measurements taken at right angles to each other at any point along the length.

④Not applicable in the annealed (-0) temper or if wall thickness is less than 2½ percent of the outside diameter or equivalent round diameter The equivalent round diameter is the diameter of a circle having a circumference equal to the perimeter of the tube.

⑤Example: The width tolerance of 1 x 3 inch rectangular tube is ±0.025 inch and the depth tolerance is ±0.035 inch.

STANDARD TOLERANCES

FOR EXTRUDED TUBE

TABLE 3 • WALL THICKNESS *ROUND TUBE*

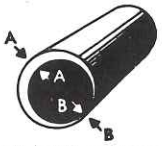
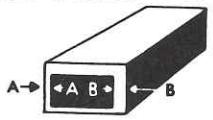
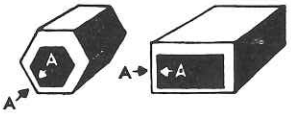
SPECIFIED WALL THICKNESS④ Inches	TOLERANCE①②—Inches Plus and Minus								
	ALLOWABLE DEVIATION OF MEAN WALL THICKNESS③ FROM SPECIFIED WALL THICKNESS  Difference between ½ (AA+BB) and specified wall thickness								ALLOWABLE DEVIATION OF WALL THICKNESS AT ANY POINT FROM MEAN WALL THICKNESS③ (Eccentricity) Difference between AA and mean wall thickness
	OUTSIDE DIAMETER—Inches								
	Under 1.250		1.250-2.999		3.000-4.999		5.000 and over		
Col. 1	Col. 2		Col. 3		Col. 4		Col. 5		Col. 6
	Alloys 5083, 5086, 5456	Other Alloys	Alloys 5083, 5086, 5456	Other Alloys	Alloys 5083, 5086, 5456	Other Alloys	Alloys 5083, 5086, 5456	Other Alloys	All Alloys
Under 0.047	.009	.006	.....	.....	.....	.....	.....	.....	Plus and minus 10% of mean wall thickness max ±0.060 min ±0.010
0.047-0.061	.011	.007	.012	.008	.012	.008	.015	.010	
0.062-0.077	.012	.008	.012	.008	.014	.009	.018	.012	
0.078-0.124	.014	.009	.014	.009	.015	.010	.023	.015	
0.125-0.249	.014	.009	.014	.009	.020	.013	.030	.020	
0.250-0.374	.017	.011	.017	.011	.024	.016	.038	.025	
0.375-0.499	.....	.....	.023	.015	.032	.021	.053	.035	
0.500-0.749	.....	.....	.030	.020	.042	.028	.068	.045	
0.750-0.999	.....	.....	.....	.....	.053	.035	.083	.055	
1.000-1.499	.....	.....	.....	.....	.068	.045	.098	.065	
1.500-2.000	.....	.....	.....	.....	.....	.....	.113	.075	

TABLE 4 • WALL THICKNESS *OTHER-THAN-ROUND TUBE*

SPECIFIED WALL THICKNESS④ Inches	TOLERANCE①②—Inches Plus and Minus					
	ALLOWABLE DEVIATION OF MEAN③ WALL THICKNESS FROM SPECIFIED WALL THICKNESS  Difference between ½ (AA+BB) and specified wall thickness				ALLOWABLE DEVIATION OF WALL THICKNESS AT ANY POINT FROM MEAN WALL THICKNESS③ (Eccentricity)  Difference between AA and mean wall thickness	
	CIRCUMSCRIBING CIRCLE DIAMETER⑤—Inches					
	Under 5.000		5.000 and over		Under 5.000	5.000 and over
Col. 1	Col. 2		Col. 3		Col. 4	Col. 5
	Alloys 5083, 5086, 5456	Other Alloys	Alloys 5083, 5086, 5456	Other Alloys	All Alloys	All Alloys
Under 0.047	.008	.005	.012	.008	.005	Plus and minus 10% of mean wall thickness max ±0.060 min ±0.010
0.047-0.061	.009	.006	.014	.009	.007	
0.062-0.124	.011	.007	.015	.010	.010	
0.125-0.249	.012	.008	.023	.015	.015	
0.250-0.374	.017	.011	.030	.020	.025	
0.375-0.499	.021	.014	.045	.030	.030	
0.500-0.749	.038	.025	.060	.040	.040	
0.750-0.999	.053	.035	.075	.050	.050	
1.000-1.499	.068	.045	.090	.060	.060	
1.500-2.000	.....	.....	.105	.070	.....	

①When outside diameter, inside diameter, and wall thickness (or their equivalent dimensions in other-than-round tube) are all specified, standard tolerances are applicable to any two of these dimensions, but not to all three.

②When a dimension tolerance is specified other than as an equal bilateral tolerance, the value of the standard tolerance is that which would apply to the mean of the maximum and minimum dimensions permissible under the tolerance.

③The mean wall thickness of round tube is the average of two measurements taken opposite each other. The mean wall thickness of other than round tube is the average of two measurements taken opposite each other at approximate center line of tube and perpendicular to the longitudinal axis of the cross section.

④When dimensions specified are outside and inside, rather than wall thickness itself, allowable deviation at any point (eccentricity) is plus and minus 10 percent of the mean wall thickness; maximum ±0.060 inch, minimum ±0.010 inch.

⑤The circumscribing circle diameter is the diameter of the smallest circle that will completely enclose the tube.

STANDARD TOLERANCES

FOR EXTRUDED TUBE

TABLE 5 • LENGTH

SPECIFIED OUTSIDE DIAMETER OR WIDTH Inches	TOLERANCE—Inches Plus except as noted							
	ALLOWABLE DEVIATION FROM SPECIFIED LENGTH							
	STRAIGHT				COILED			
	SPECIFIED LENGTH—Feet							
	Up through 12	Over 12 through 30	Over 30 through 50	Over 50	100 and less	101 through 249	250 through 499	500 and over
Under 0.500	..	..	..	..	+5%, −0%	±10%	±15%	±20%
0.500-1.249	1/8	1/4	3/8	1	+5%, −0%	±10%	±15%	±20%
1.250-2.999	1/8	1/4	3/8	1	.....	.....	.....	.....
3.000-7.999	3/16	5/16	7/16	1	.....	.....	.....	.....
8.000 and over	1/4	3/8	1/2	1	.....	.....	.....	.....

TABLE 6 • CORNER RADII

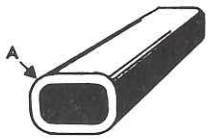
SPECIFIED RADIUS Inches	TOLERANCE—Inches
	ALLOWABLE DEVIATION FROM SPECIFIED RADIUS  Difference between radius A and specified radius
Sharp corners	+1/64
Under 0.188	±1/64
0.188 and over	±10%

TABLE 7 • FLATNESS (Flat Surfaces)

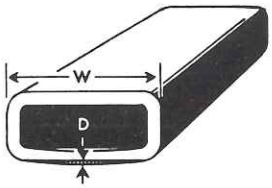
SPECIFIED WALL THICKNESS	TOLERANCE Inches per Inch of Width
	 D (max) = W x 0.004 or 0.006
Under 0.188	.006; .006 min
0.188 and over	.004; .004 min

TABLE 8 • ANGULARITY

Allowable deviation from specified angle: ±2 degrees.

①*Not applicable in the annealed (-0) temper.*

TABLE 9 • SQUARENESS OF CUT ENDS

Allowable deviation from square: 1 degree.

TABLE 10 • STRAIGHTNESS

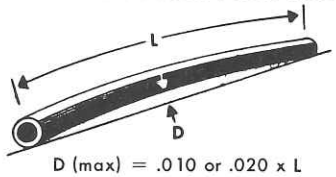
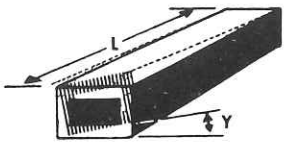
SPECIFIED OUTSIDE DIAMETER OR WIDTH Inches	TOLERANCE①②—Inches	
	ALLOWABLE DEVIATION FROM STRAIGHT  D (max) = .010 or .020 x L	
	IN EACH FOOT OF LENGTH	IN TOTAL LENGTH OF PIECE
0.500-5.999	.010	.010 x Length, ft
6.000 and over	.020	.020 x Length, ft

TABLE 11 • TWIST

SPECIFIED WIDTH Inches	TOLERANCE①—Degrees	
	ALLOWABLE DEVIATION FROM STRAIGHT  Y (max) = 1°, ½°, or ¼° x L	
	IN EACH FOOT OF LENGTH	IN TOTAL LENGTH OF PIECE
Under 1.500	1°	1° x Length, ft
1.500-2.999	½°	½° x Length, ft: 5° max
3.000 and over	¼°	¼° x Length, ft: 3° max

②*For all sizes of other-than-round tube, tolerance is applicable when weight of tube on flat surface minimizes deviation.*

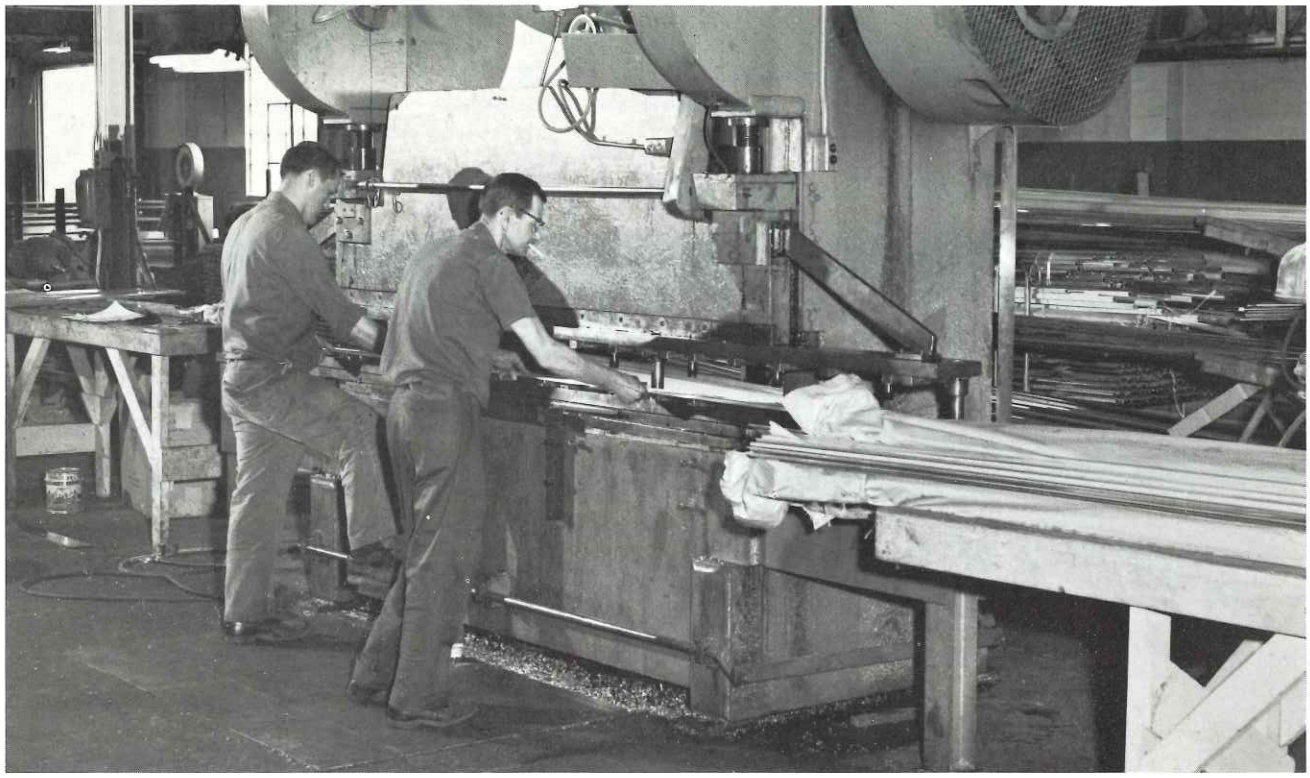
NOTE: All extruded shapes tolerances are supplied to standards set up by the Aluminum Association.

"GENERALINE" FABRICATION

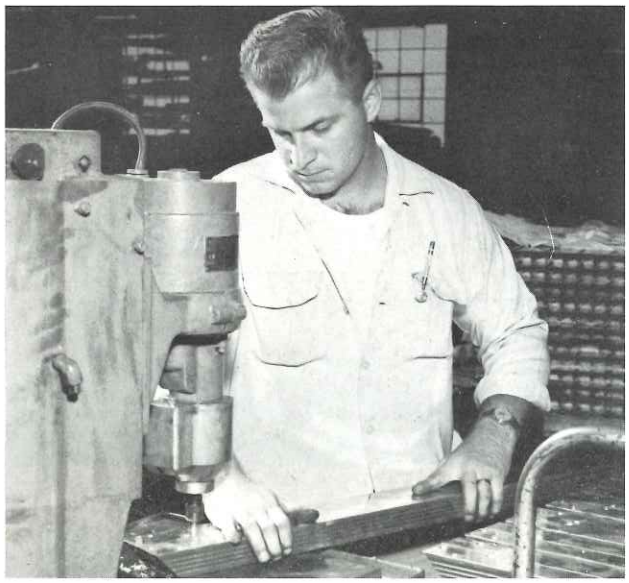
GEI is called upon to perform countless other operations following the extrusion of shapes. Many of these operations — bending, forming, punching, welding, drilling, milling, slotting, mitering — take place in GEI's completely-equipped Fabrication Department. These are steps prior to assembly. A "full service" aluminum extruder, GEI can handle assembly assignments . . . and often does.

GEI's recently expanded, completely-equipped Fabrication Department.

"GENERALINE" FABRICATION



Punching operation is performed with press brake.



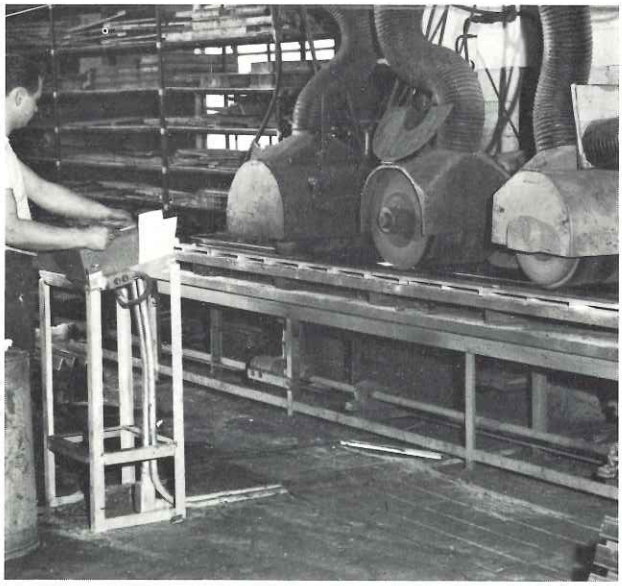
Holes are precisely drilled into shape with mitered corner.

Milling slot into extrusion is handled in GEI's Fabrication Department

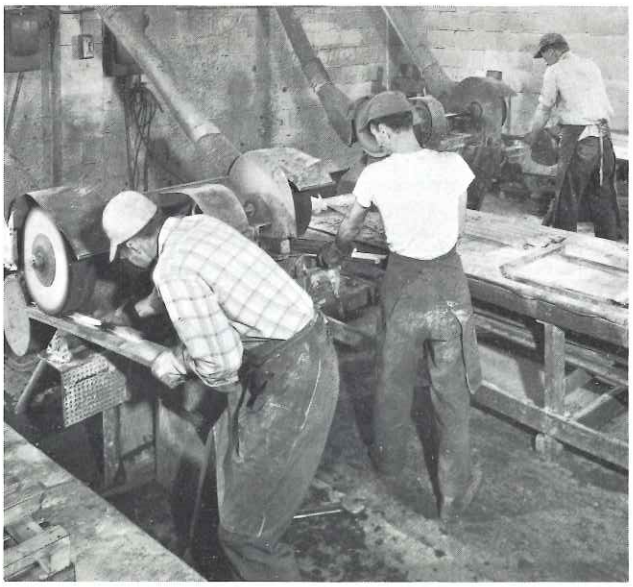
"GENERALINE" FINISHING

General Extrusions' reputation for superior finishes is, in part, due to expert polishing and buffing as shown in process in these photos. Other finishing services include expert sanding and brushing.

GEI's automatic tube polisher gives a uniform mirror finish.



This automatic straight line polisher reduces costs in addition to insuring a bright, uniform finish.



Hand buffing is another of GEI's many services.

"GENERALINE" SPECIAL FINISHES

GENERALSATIN FINISH (204R1)

Satin finish accomplished by putting the "as extruded" sections through an etching process, then anodizing to a satin finish. A beautiful natural finish that is ideal for storm windows and doors, store fronts and a host of industrial applications. Excellent base for painting. Guaranteed not to rub off black or smudge.

GENERALUCENT FINISH (A2)

Very bright, sparkling, chrome-like finish accomplished through hand buffing by General's long-experienced artisans. Each piece a mirror.

GENERALITE FINISH (204A2R1)

Alumite finishes produced by General are certified to Army, Navy and Air Force specifications where required. Generalite finish is a striking pearl-like natural aluminum finish — obtained by first buffing, then a slight etch, followed by the anodizing process. Excellent for outdoor use, will not rub off black or smudge.

GENERALUSTRE FINISH (204A2)

Bright, lustrous, a truly deluxe finish. Accomplished by the Anodizing process, it is impervious to time and the elements. Will not rub off black, oxidize, smear or spot. Produced by polishing to a high luster, then subjecting to electrolytic process, and finally processing to seal against spotting.

GENERALBRITE (204R5)

Another finish by General that will give you a permanent Bright Chrome Finish, the chemical brite dip process. Buffing is not required, although it will increase brightness and luster.

GENERALEAF GOLD (204-145 GOLD)

A beautiful Gold color obtained by our own color anodizing process — for interior and exterior applications. Other colors available in the primary and pastel shades subject only to volume orders.

PAINTING, SILK SCREENING AND LITHOGRAPHING

In addition to above finishes we are equipped to spray paint, silk screen and lithograph all types of Aluminum Shapes.

Masking of parts to provide a painted surface where desired is available, also all colors. Parts can be polished or Anodized plain or in color prior to painting, silk screening or lithographing.

"GENERALINE" SPECIAL FINISHES

KEY TO TYPE OF SURFACE PREPARATION

Suffix	Type of Surface Preparation.	Suffix	Type of Surface Preparation.
No suffix	As-fabricated surface.	G3	Medium blast.
A1	Preliminary grinding and polishing prior to buffing.	G4	Coarse blast.
A2	Buff directly on as-fabricated surface.	H1	Fine shot blast.
B	Ground finish (round tubing only)	H2	Medium shot blast.
C1	Polish finish, No. 180-220 emery or finer.	H3	Coarse shot blast.
C2	Satin finish, hand rubbed.	K	Wire-brush finish.
C3	Satin finishing compound, or brushed backed sander.	M	Burnished finish.
D	Polish finish, No. 140-180 emery.	N	Sand-burnished finish.
E	Polish finish. No. 120-140 emery.	R1	Caustic etch.
G1	Very fine sand blast (formerly "Dust Blast").	R2	Caustic etch for diffusion reflectors
G2	Fine blast.	R3	Sulfuric-chromic etch.
		R4	Bright dip (nitric-hydrofluoric).
		R5	Bright dip.

ALUMILITE COATINGS FOR WROUGHT PRODUCTS

Coating Designation	Sealed With	Approximate Coating Thickness, Mils[1]	Approximate Coating Weight, mg/in.[2] [6]	
			On Alloys 1100, 3003, 5052, 5005, 5357, 5457, 5557, 6463, 6563, 6061, 6063	2014, 2024 On Alloys
Alumilite 200	Boiling Water	0.15	8.0	3.0
Alumilite 201	Boiling Water	0.2	10.0	5.0
Alumilite 202	Boiling Water	0.3	14.0	7.0
Alumilite 300	Nickel acetate	0.15	8.0	-------
Alumilite 301	Nickel acetate	0.2	10.0	-------
Alumilite 302	Nickel acetate	0.3	14.0	-------
Alumilite 203	Boiling Water	0.35	17.0	10.0
Alumilite 204	Boiling Water	0.4	21.0	11.0
Alumilite 205x	Chromate[2]	0.2	-------	-------
Alumilite 210x	Chromate[2]	0.4	-------	-------
Alumilite 211	Boiling Water	0.8	40.0	-------
Alumilite 214	Boiling Water	0.6	30.0	-------
Alumilite 215[4]	Boiling Water	0.8	40.0	17.0
Alumilite 224	Boiling Water	0.4	-------	-------
Alumilite 225[5]	†None	1.0	43.0	33.0
Alumilite 226[5]	†None	2.0	86.0	66.0
Alumilite 231	Wax emulsion[3]	0.2	10.0	5.0
Alumilite 1224xx	Boiling Water	0.1	6.0	3.0

[1] 1 mil = 1/1000 of an inch.

[2] Chromate sealing gives coating yellow color.

[3] Recommended for ice cube trays.

[4] Recommended for application requiring high resistance to wear.

[5] Have exceptional resistance to abrasion and erosion.

x Meets Mil-A-8625A spec (Type II)

xx Meets Mil-A-8625A spec (Type I)

[6] Miligrams per square inch.

† Sealing not required.

NOTE:

The values given in this table are only approximate values and should not be used for specification purposes.

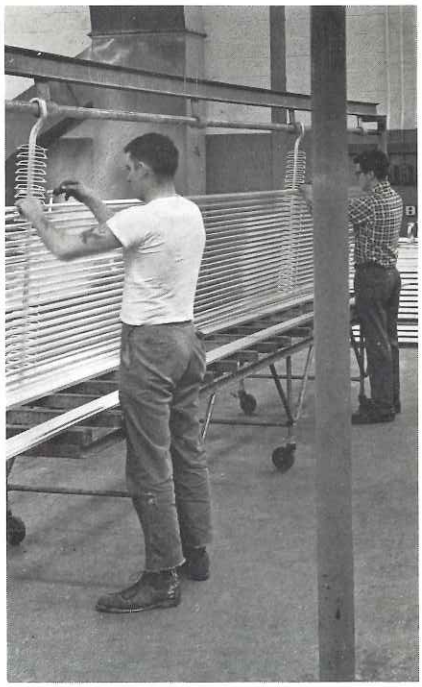
VAPOR BLAST FINISHES

A special finish can be obtained through use of GEI's vapor blaster to remove metal defects such as nicks, scratches, die lines and flow lines. Vapor blasting can be done in various degrees of coarse to very fine. It is ideal for two-tone color where the same extrusion can contain both a polished and a satin finish.

"GENERALINE" ANODIZING

Aluminum becomes a beautiful metal through etching, Brite Dip or color anodizing. Craftsmen applying any one or a combination of these finishes turn an extruded shape into a decorative as well as functional unit. GEI has the craftsmen . . . using the newest, most efficient equipment available. They work in expanded, modernized quarters. An example of the modernization in the Anodizing Department is a new lighting system which creates a daylight effect. This makes it possible to more efficiently check color matchings and finishes.

Rack of shapes is lowered into the first of many tanks to begin anodizing operation.



Careful positioning of shapes on racks is important to quality anodizing.

COLOR ANODIZING

Lengths up to 22 feet can be anodized in a full range of colors . . . in volume or small lots. Gold is in the tank at all times. Typical GEI attention to smaller users brings amazing low-price schedules to lower volume applications. Quantity orders of special colors are now less than ever before.

"GENERALINE" SHIPPING

Often as important as quality control is expert care during packaging. Extra care is taken in the GEI Shipping Department — recently doubled in size as a part of GEI'S overall expansion program — to eliminate marring of finishes and distortion of shapes while in transit. There is no stinting of packaging materials such as individual sleeves, shock padding or sturdy outer layers. This final step in handling a customer's order is typical of GEI efficiency.

SHIPPING TOLERANCES

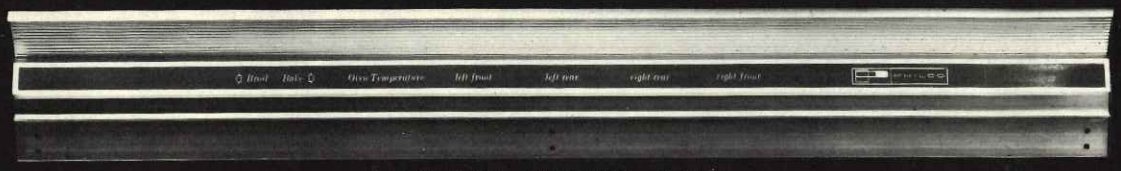
SPECIFIED QUANTITY PER ORDER ITEM	TOLERANCE PER CENT Allowable deviation from specified weight or count
Under 500 pounds	±10
500 to (not incl.) 10,000 pounds	±5
10,000 pounds and over	±3

These Standard Tolerances apply to average shapes. Closer tolerances on special application.

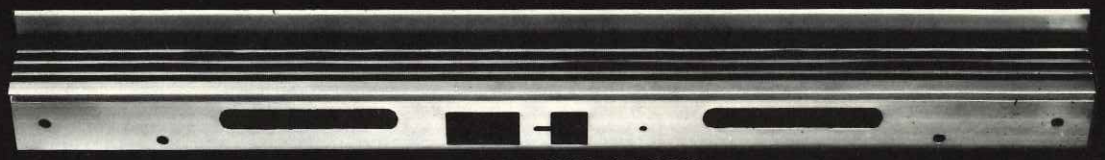
Extruded aluminum shapes are carefully packaged to protect finishes and to prevent distortion while in transit.

Speedy delivery of orders requires coordination in all departments. Shipping department at GEI moves all orders out quickly.

A FEW OF THE COUNTLESS



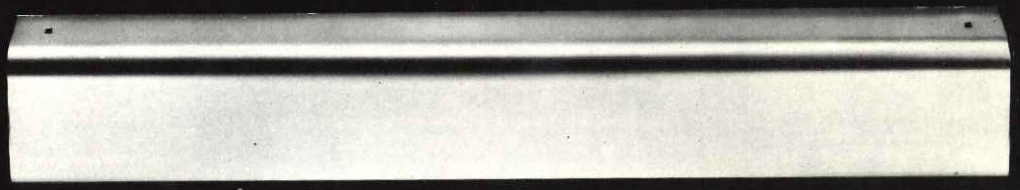
BACK TRIM, ELECTRIC RANGE



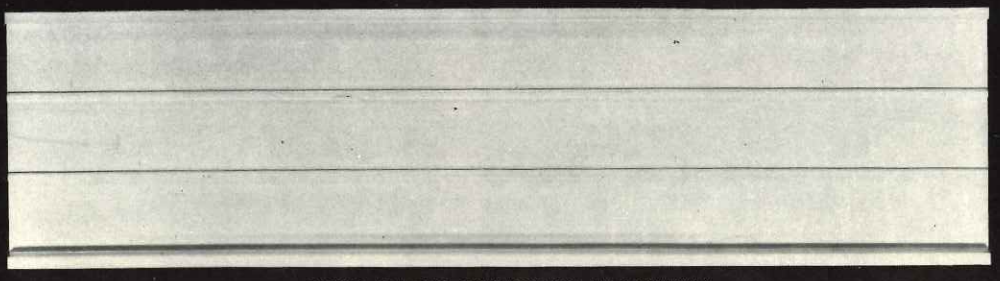
BOTTOM TRIM, RANGE

BOTTOM TRIM, GAS SPACE HEATER

AUTOMATIC VENDING MACHINE



AUTOMATIC VENDING MACHINE



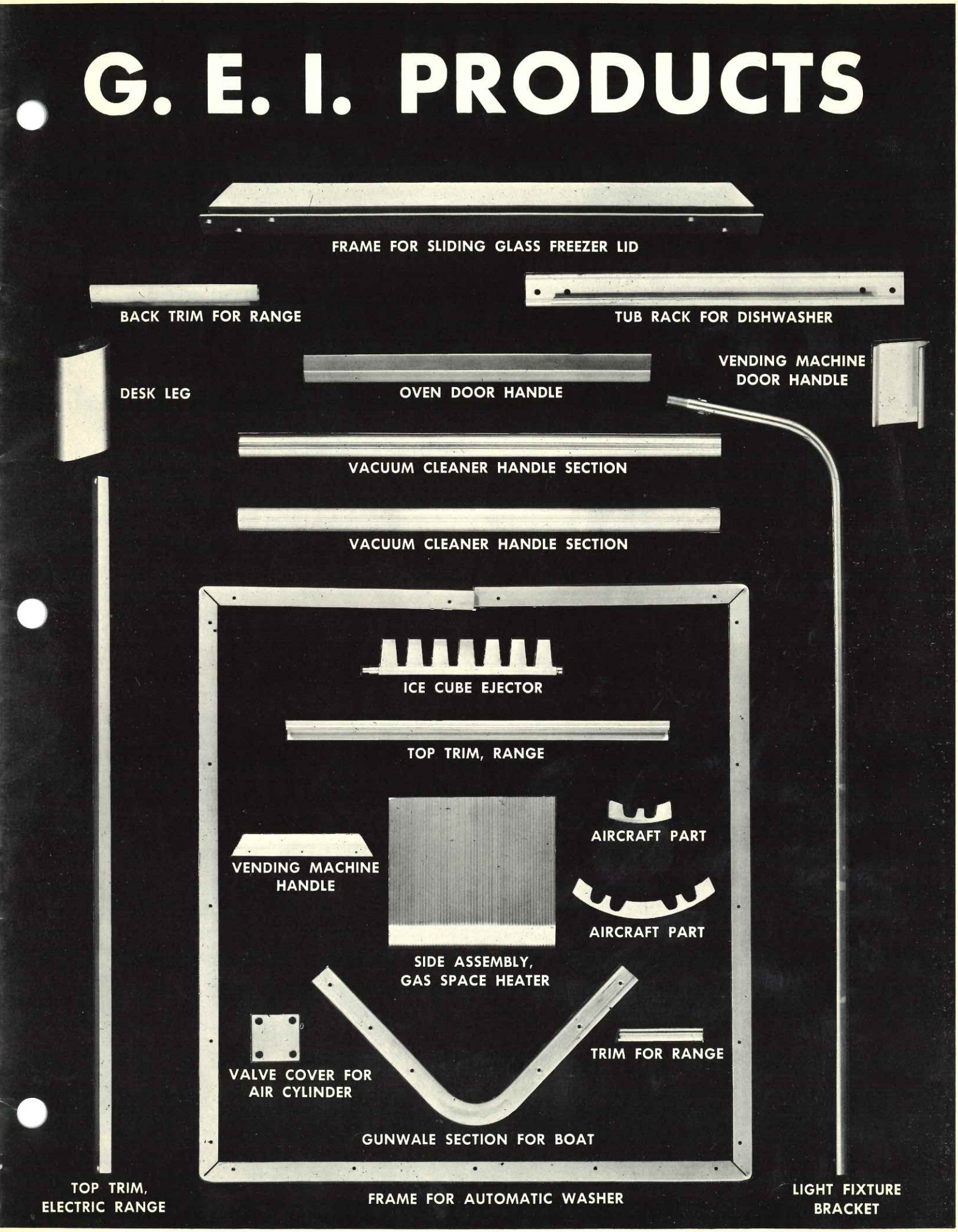
AUTOMATIC VENDING MACHINE

MIRROR FRAME SECTION

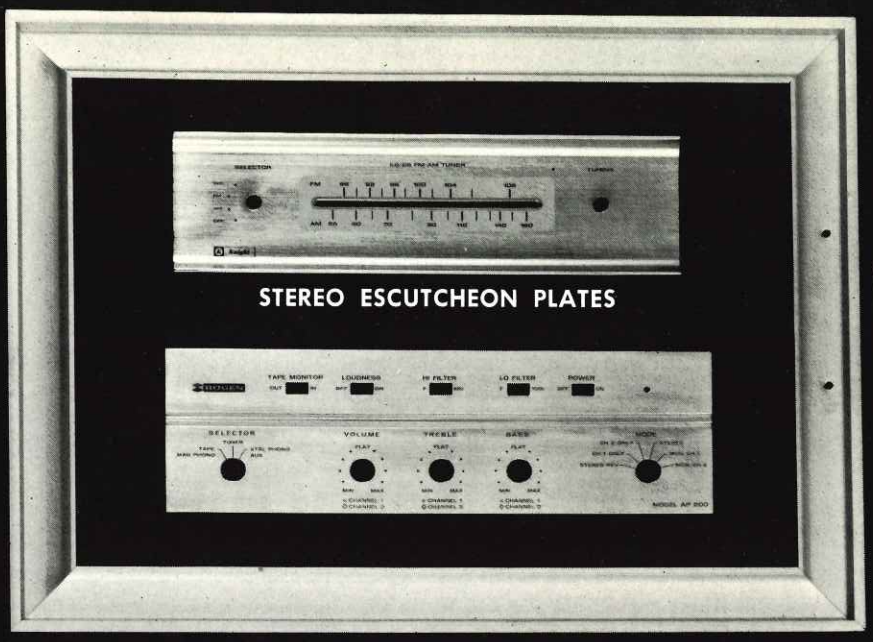
DRAWER PULL FOR DISHWASHER

AUTOMOTIVE PART

G. E. I. PRODUCTS



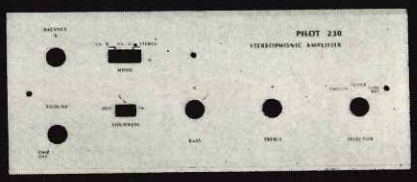
AUTOMOTIVE GRILL TRIM



STEREO ESCUTCHEON PLATES

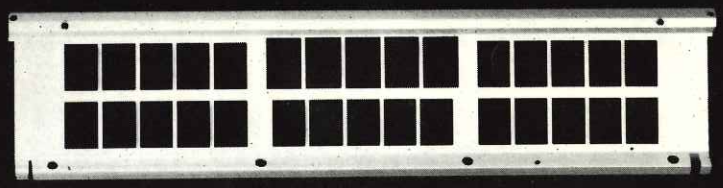
WELDED OVEN DOOR FRAME

STEREO ESCUTCHEON PLATE

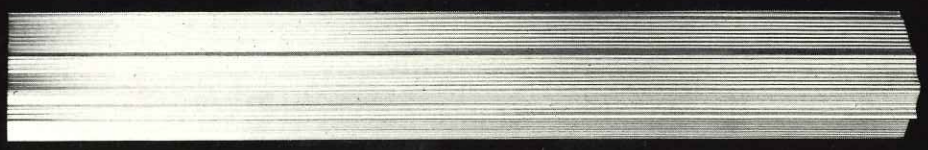


STEREO ESCUTCHEON PLATE

BRACKET FOR COAT HANGER RACK

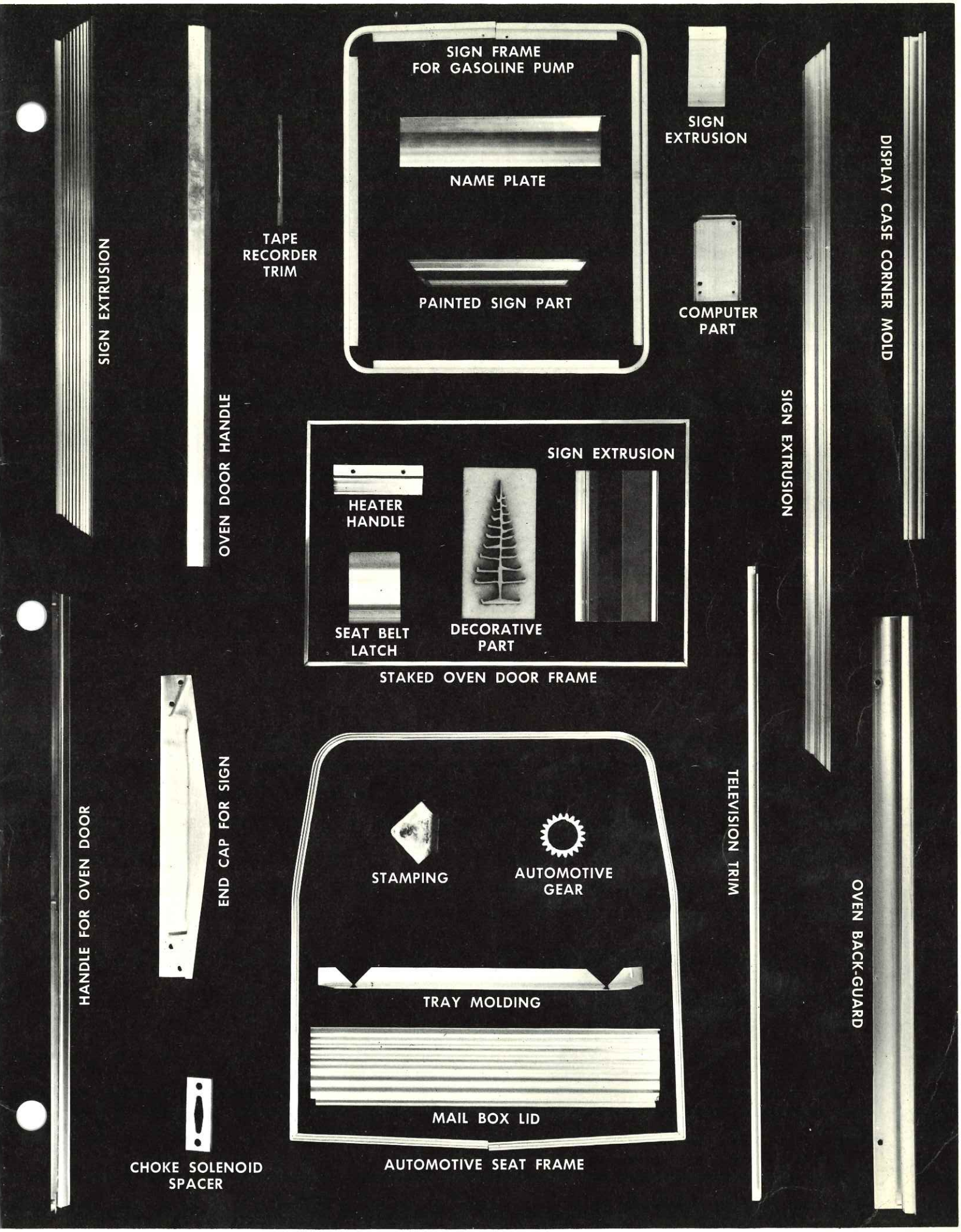


VENDING MACHINE ESCUTCHEON PLATE



TROPHY MATERIAL

CHECKOUT COUNTER CONVEYOR TRACK


SIGN FRAME
FOR GASOLINE PUMP
NAME PLATE
PAINTED SIGN PART
SIGN EXTRUSION
COMPUTER PART
TAPE RECORDER TRIM
SIGN EXTRUSION
OVEN DOOR HANDLE
DISPLAY CASE CORNER MOLD
SIGN EXTRUSION
SIGN EXTRUSION
HEATER HANDLE
SEAT BELT LATCH
DECORATIVE PART
STAKED OVEN DOOR FRAME
END CAP FOR SIGN
HANDLE FOR OVEN DOOR
STAMPING
AUTOMOTIVE GEAR
TELEVISION TRIM
OVEN BACK-GUARD
TRAY MOLDING
MAIL BOX LID
CHOKE SOLENOID SPACER
AUTOMOTIVE SEAT FRAME

GEI CAN HANDLE YOUR SPECIAL NEEDS AND PROBLEMS IN ALUMINUM EXTRUSIONS

Even before your requirements are definitely established in the case of new parts development, GEI's engineering department is at your disposal for consultation, without obligation. For certain needs, GEI's plant facilities are available singly, and customers send their aluminum parts in, simply to be color or natural anodized, machined, finished or for additional fabrication.

ALUMINUM EXTRUSIONS INC. "GENERALINE" ®

GENERAL EXTRUSIONS, INCORPORATED

4040 Lake Park Road • P. O. Box J • Telephone 788-9681 • YOUNGSTOWN 7, OHIO

SALES OFFICES

Box 4772
Cleveland 26, Ohio
Ph. 331-9538

9416 Main St.
Montgomery (Cincinnati 42) Ohio
Ph. 791-8966

251 Guenevere Drive
Pittsburgh, Pa.
Ph. 364-0471

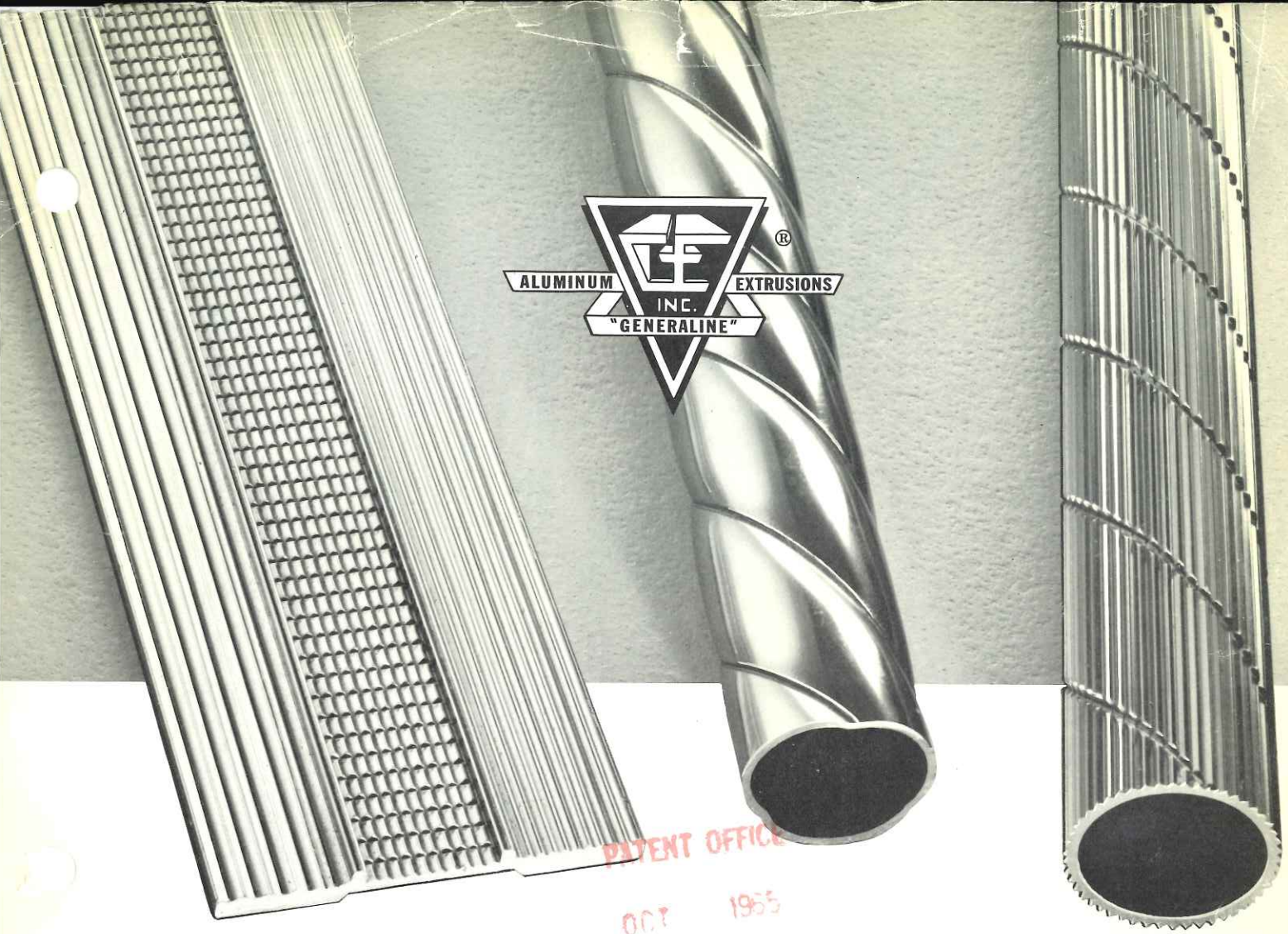
4378 Lindell Blvd.
St. Louis, Mo.
Ph. 533-5400

2034 College Ave.
Grand Rapids 7, Mich.
Ph. 243-8505

326 S. Bristol Lane
Arlington Heights, Ill
Ph. 255-8814

3505 Turtle Creek Blvd.
Dallas 19, Texas
Ph. 521-2196

Hamilton Natl. Bank Bldg.
Chattanooga, Tenn.
Ph. 266-2262



PATENT OFFICE
OCT 1955

GENERALINE

Adds Decorative Touch To Extruded Aluminum Tubing or Design Parts

SPIRAL SCROLL FLUTING

Either plain or fluted extruded aluminum tubing with the spiral design as illustrated is available from General Extrusions in the following diameters: 3/8", 1/2", 5/8", 3/4", 7/8", 1", 1 1/2", 2".

There is no die charge for these special extrusions.

Spiral scroll tubing can be furnished in other sizes but these will be subject to nominal die service charges.

PATTERNED ALUMINUM EXTRUSIONS

A multitude of functional as well as decorative applications can be served with this method of inscribing surfaces transverse to metal flow.

The pattern in the center panel of the flat extrusion illustrated is the Generaline rectangular block pattern. It provides a surface which is non-slip as well as decorative. General Extrusions also can furnish a diamond pattern or a diagonal pattern. Stock design rolls are available up to 3/4" wide in these designs. Greater widths require new rolls and are comparatively inexpensive.

DESIGNS AND PATTERNS ALSO MAY CONSIST OF WORDS OR TRADEMARKS

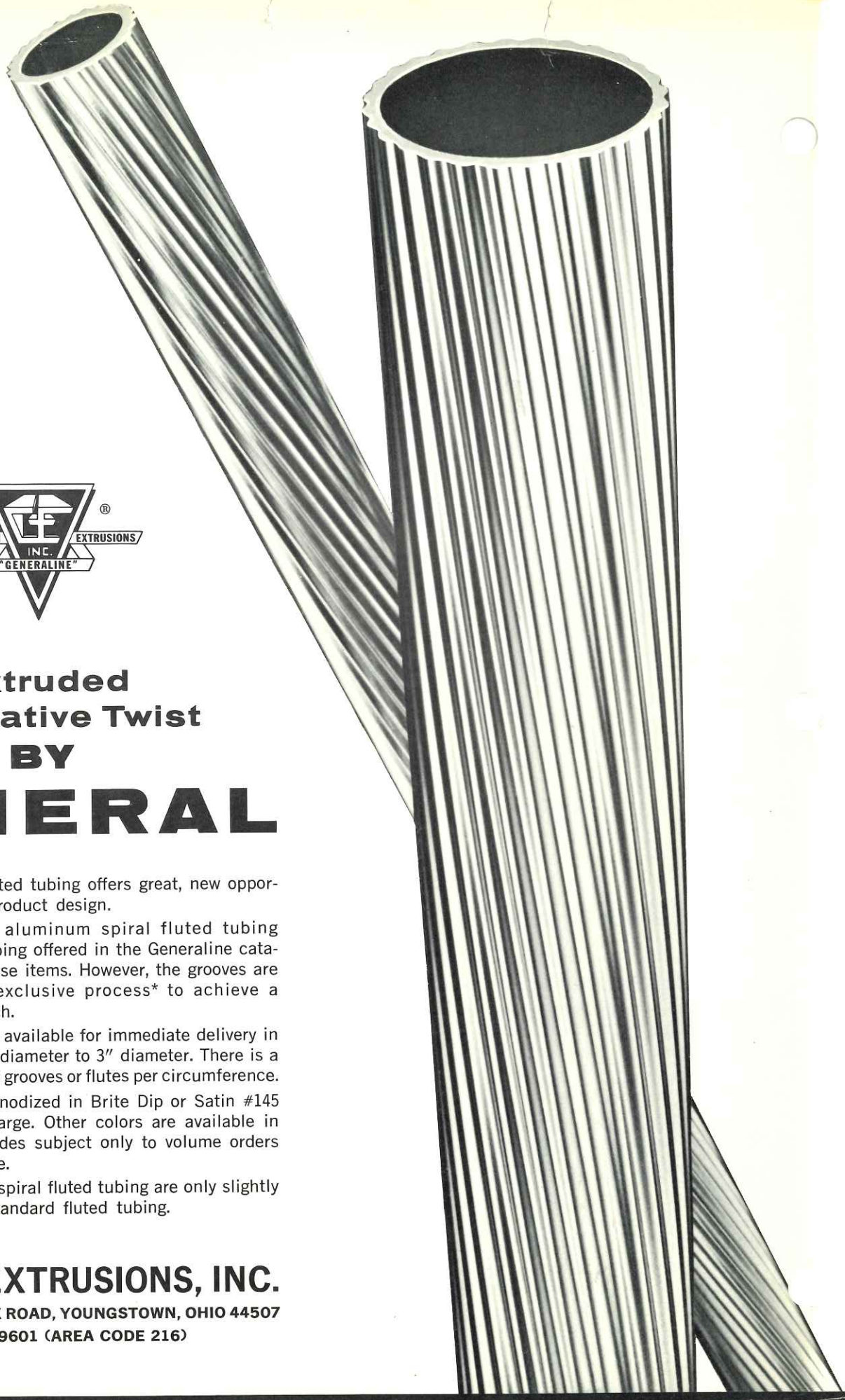
Your own extruded shape in most cases can be designed to incorporate one or all of the three standard patterns. General Extrusions offers expert consultation advice for new applications of patterned aluminum extrusions.

Colors and Finishes

Spiral Scroll Tubing and patterned extrusions may be anodized in #145 Gold without set-up charge. Other colors are available in primary and pastel shades subject only to volume orders or a slight set-up charge.

Various finishes are available including plain, satin, polished, brite dip, sand blast and painted.

GENERAL EXTRUSIONS, INC. • BOX J, 4040 LAKE PARK ROAD, YOUNGSTOWN, OHIO 44507 • PHONE 788-9601 (AREA CODE 216)



ALUMINUM EXTRUSIONS INC. "GENERALINE"

Extruded Decorative Twist BY GENERAL

This exclusive spiral fluted tubing offers great, new opportunities for attractive product design.

Generaline extruded aluminum spiral fluted tubing resembles the fluted tubing offered in the Generaline catalog of standard warehouse items. However, the grooves are gently spiraled by an exclusive process* to achieve a modern, decorative touch.

Spiral fluted tubing is available for immediate delivery in assorted sizes from 3/8" diameter to 3" diameter. There is a wide choice in number of grooves or flutes per circumference.

This tubing may be anodized in Brite Dip or Satin #145 Gold without set-up charge. Other colors are available in primary and pastel shades subject only to volume orders or a small set-up charge.

Prices for Generaline spiral fluted tubing are only slightly higher than those of standard fluted tubing.

*Patent Applied For

GENERAL EXTRUSIONS, INC.

BOX J, 4040 LAKE PARK ROAD, YOUNGSTOWN, OHIO 44507
PHONE 788-9601 (AREA CODE 216)

Specialists in Engineering, Extruding, Fabricating and Finishing of Aluminum